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Evaluation Criteria and Methodology

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Evaluation Methodology Group (EMG)

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Evaluation Methodology Group Charter

"Develop a process for the systematic evaluation of the comparative performance of proposed Generation IV concepts against established Generation IV Goals"

EMG Responsibilities

- *Support the Roadmap Integration Team (RIT) in defining the evaluation process*
- *Develop a methodology for evaluating the performance of concepts against the goals and for prioritizing R&D requirements*
- *Define evaluation methods, criteria and metrics*
- *Support the RIT and Technology Working Groups (TWGs) in applying the evaluation methodology during the screening evaluations; support and review for consistency in application*

EMG Deliverables and Schedule

- *Screening for Potential Methodology*

  June 2001

  – *Description of the method, criteria and metrics to be used in the Screening for Potential*

- *Final Screening and R&D Prioritization Methodology*

  December 2001

  – *Description of the method, criteria and metrics for the Final Screening and guidance for concept selection and R&D prioritization*

- *Viability and Performance Evaluations Methodology*

  June 2002

  – *Recommendation of the method, criteria and metrics for the future concept evaluations*

  – *Recommendation for methodology evaluation development*

Criteria and Metrics

- *Create criteria that:*
  - *Reflect the intent of the Gen IV Goals*
  - *Provide indication of significant progress toward Goals*
  - *Will discriminate between system performance*
  - *Present a reasonable work load for the TWGs*
- *Create metrics that:*
  - *Are quantitative where possible*
  - *Allow qualitative assessment where needed*
  - *Lead to future key information needs:*
    - *Safety Analysis*
    - *Environmental*
    - *Business Case*

Criteria and Metrics Example

SU1-1: Fuel Utilization

Generation IV systems will reduce the depletion of nuclear fuel resources.

***Discussion:** Assessment of the Sustainability Criterion 1 for a nuclear energy system is concerned with its depletion of fuel. The basic principle is that Gen IV systems will have longer natural time scales of use for a given amount of energy production. The attributes or factors to be considered in determining the degree to which a system satisfies this criterion are its specific demands (consumption per unit of energy (either electrical or thermal produced from a reactor) for fuel compared to the economically accessible resource inventory of such fuel.*

Use of fuel resources: final screening metric scale

Much worse than reference	Worse than reference	Slightly worse than reference	Similar to reference	Slightly better than reference	Better than reference	Much better than reference
>300 Mt U feed/GWyr	250-300 Mt U feed/GWyr	200-250 Mt U feed/GWyr	150-200 Mt U feed/GWyr	100-150 Mt U feed/GWyr	10-100 Mt U feed/GWyr	<10 Mt U feed/GWyr

Criteria and Metrics Example

SR1-3: Worker Safety - Accidents

Generation IV nuclear energy systems will excel in safety and will not expose workers to significant accident hazard, involving radiation, hazardous materials, or severe physical conditions.

Proposed metrics:

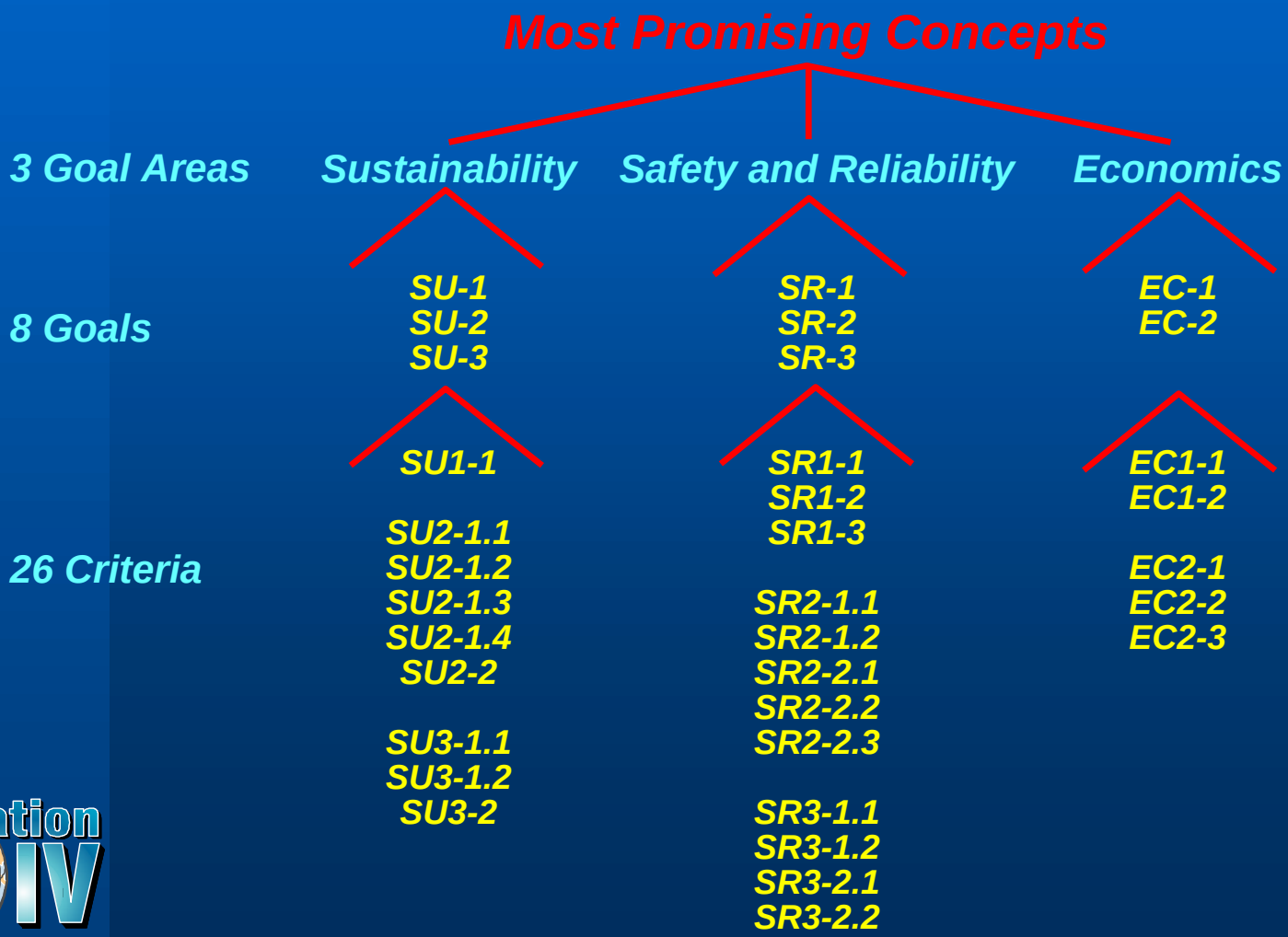
3.1. Accidental exposure to radiation, hazardous materials or physical conditions

3.1.1. Final Screening Metric: Screen for unique radiation, chemical, toxic, and physical hazards, during handling, transport and all other phases of operations (+/=/-). Evaluators must be alert to unusual potential for accidental exposure to radiation.

Accidental exposure: final screening metric scale

Worse than reference	Similar to reference	Better than reference
Significantly greater risk of accidental personnel exposure compared to Generation III	Risk of accidental personnel exposure about the same as Generation III	Significant reduction of risk of accidental personnel exposure compared to Generation III

Rollup of Criteria, Goals and Goal Areas



Example Evaluation of SCWR

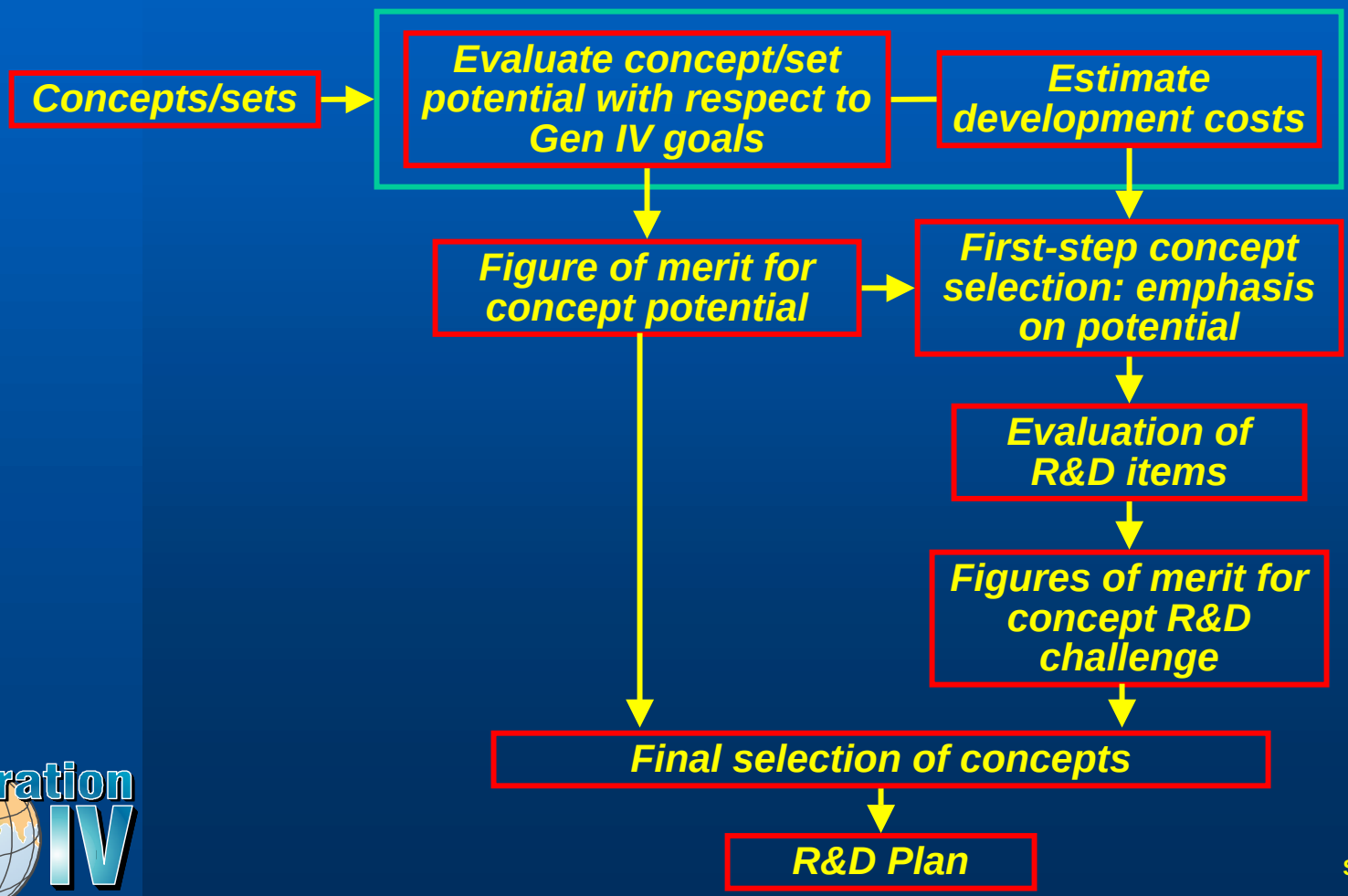
- *Handout: current evaluation of a supercritical water-cooled reactor (SCWR) concept, updated to the FSR Rev 2*

- *Each criteria has scoring distribution and comments*
- *Information is entered on standard software*
- *Results are calculated for goals and goal areas, along with distributions*

Evaluation Method Philosophy

- *Treat Gen IV goals equally*
- *Require comprehensive assessments but accept qualitative judgement*
- *Allow for different levels of system development*
- *Do not discriminate against less well developed systems*
- *Allow the technical judgement of the TWGS to prevail*
- *Provide the project leadership with a framework and sufficient information for decision making*

Final Screening Method Approach



Concept Evaluation

- *TWGs evaluate all concepts for each criteria and metric*
- *Emphasize concept performance potential*
- *Consider concept performance uncertainty*

Development Cost

- *Oak Ridge National Lab cost methodology was used as guidance (ORNL/TM-10071/R3, 1993)*
- *Includes total cost to develop including a prototype plant, if required*
- *Excludes commercialization cost such as first of a kind engineering*

Figures of Merit

- *Criteria scores are combined to obtain a Goal score for each Gen IV Goal applying criteria weights established by EMG*
- *Goal scores, equally weighted, are combined into scores for each goal area*
  - *Sustainability*
  - *Safety and Reliability*
  - *Economics*

First Step Concept Selection

- *Emphasis should be on concept potential*
- *Development cost may be used as a discriminator for similar concepts of comparable potential*
- *TWGs may eliminate concepts that are unlikely to survive final selection*

Evaluation of R&D

- *TWGs will provide a description of the R&D necessary to achieve each concepts potential*
- *The R&D Challenge for each concept will be developed as a Figure of Merit considering:*
  - *Relevance to goals*
  - *Cost*
  - *Schedule*
  - *Likelihood of success*

Final Selection

- ***Figures of Merit for Potential and R&D Challenge will be used as indicators for the Final Selection Process***
- ***Figures of Merit should not be the sole factor for concept selection***

Evaluation Methodology Path Forward

- *Review and respond to comments from GIF*
- *Revise Method to provide further guidance on R&D Challenge assessment*
- *Prepare Criteria, Metrics and Method for use in future Evaluation Phases*
- *Recommend R&D needs to support future evaluations*